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(71) Applicant(s)
Ilam Samson
8A Chesterford Gardens, LONDON,
NW3 7DE, United Kingdom

(72) Inventor(s)
Ilam Samson

(74) Agent and/or Address for Service
A Messulam & Co. Ltd
43-45 High Road, Bushey Heath, BUSHEY,
Herts, WD23 1EE, United Kingdom

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(54) Abstract Title
Touch pad/screen for electronic equipment

(57) An input device for electronic equipment (e.g. mobile phone) comprises a display screen. Variables, e.g. characters, which may be smaller in size than a fingertip, are displayed on the screen for selection by the user. A touch pad detects the position of a fingertip which is used to point at one of the displayed variables. The variable at which the user is currently pointing is highlighted to distinguish it from the other variables available for selection, e.g. by changing it from a positive to negative image, or displaying the variable separately in the centre of the screen, preferably surrounded by, in smaller fonts, the neighbouring variables. The user can enter the highlighted variable into the electronic equipment, by applying extra pressure by the finger at its current position. Alternatively the variable may be automatically entered when the fingertip keeps it highlighted for more than a predetermined length of time. Entry of an undesired variable may be prevented by ignoring actuation of the pressure switch if the relevant variable has been highlighted for less than a predetermined length of time.
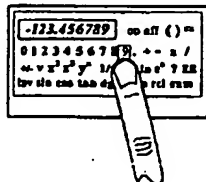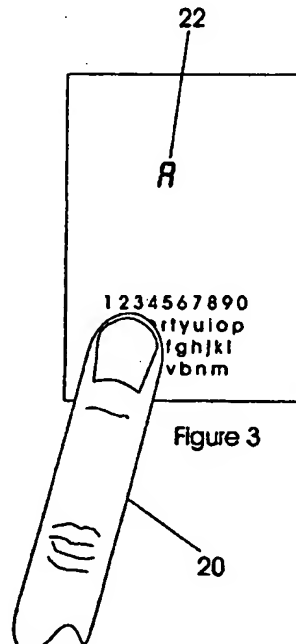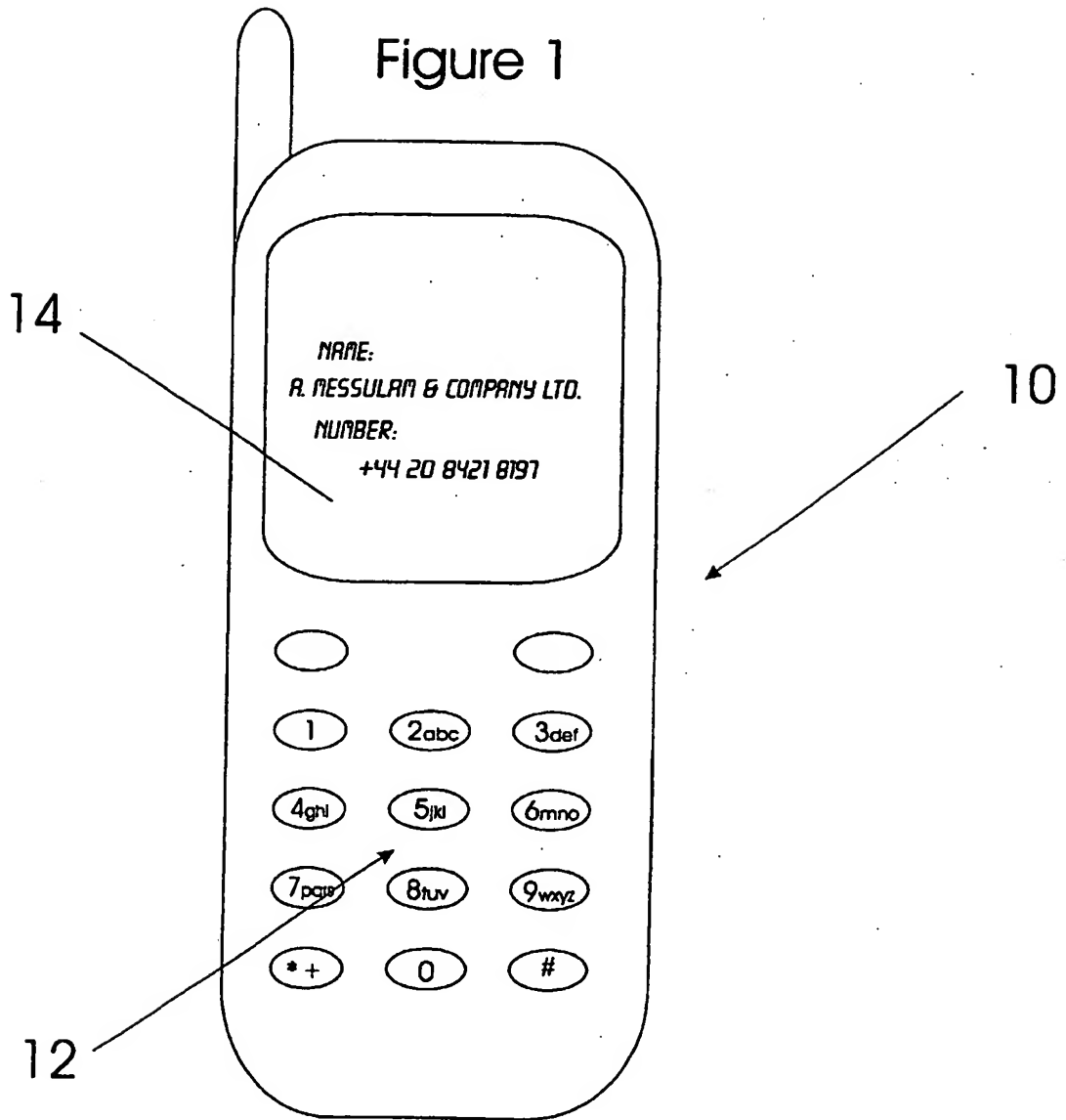
Figure 1b

Figure 3

GB 2 380 583 A

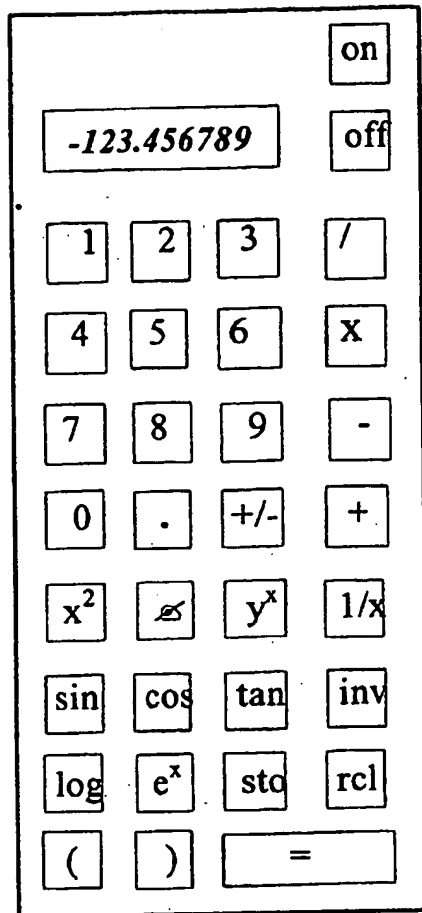## Figure 1

14

NAME:
A. MESSULAM & COMPANY LTD.
NUMBER:
+44 20 8421 8197

10

1   2abc   3def
4ghi   5jkl   6mno
7pqrs   8tuv   9wxyz
*+   0   #

12

Figure 1a

Figure 1b

22

A

1 2 3 4 5 6 7 8 9 0
qwertyuiop
asdfghjkl
zxcvbnm

Figure 2

16

18

1 2 3 4 5 6 7 8 9 0
ertyuiop
fghjkl
vbnm

Figure 3

20

Figure 5

24

A

1234567890
ertyuiop
fghjkl
vbnm

A

m
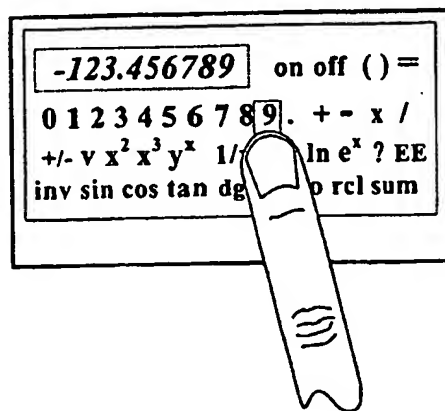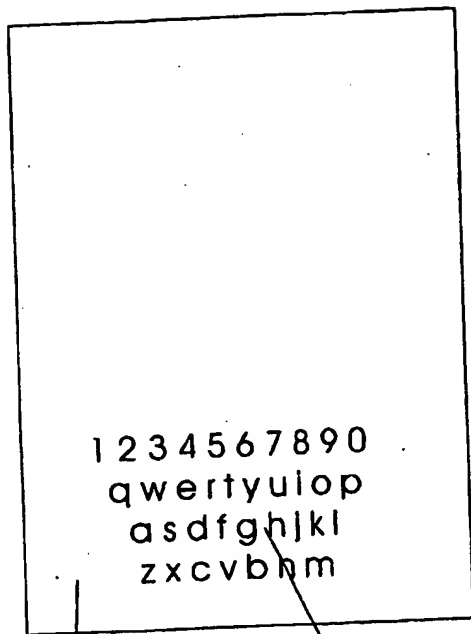
1234567890
qwertyuiop
asdfgh
zxcvb
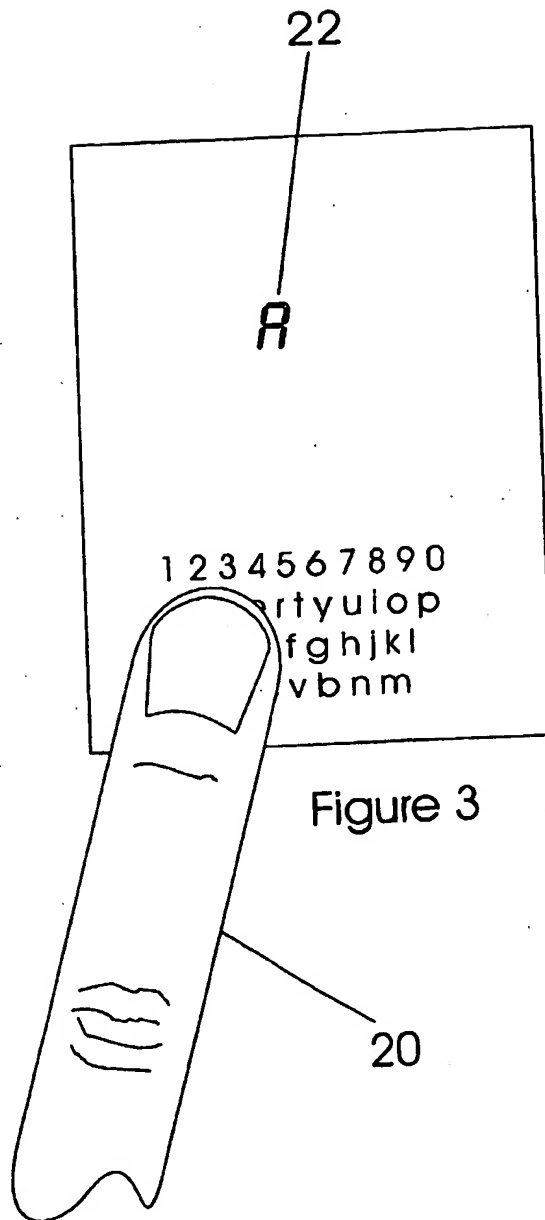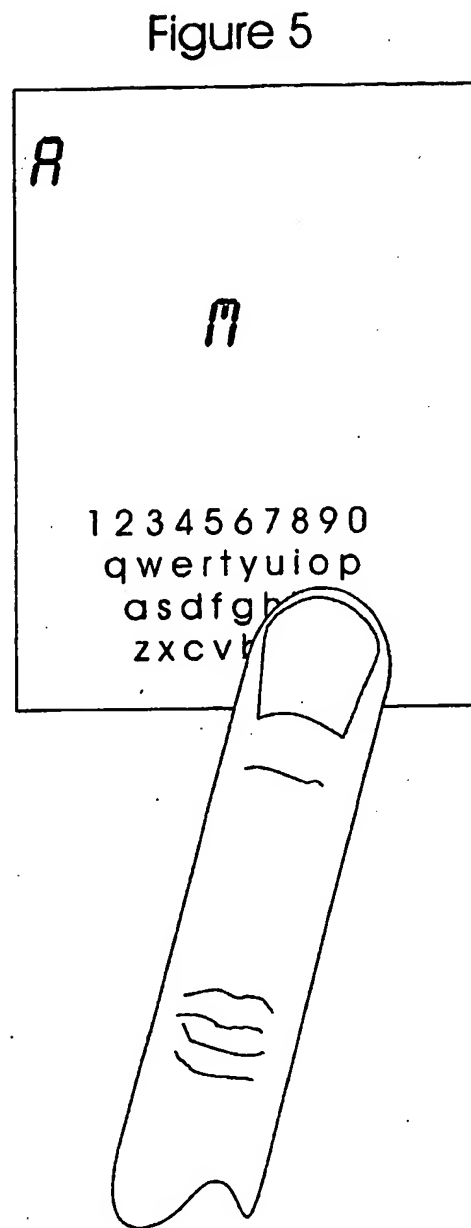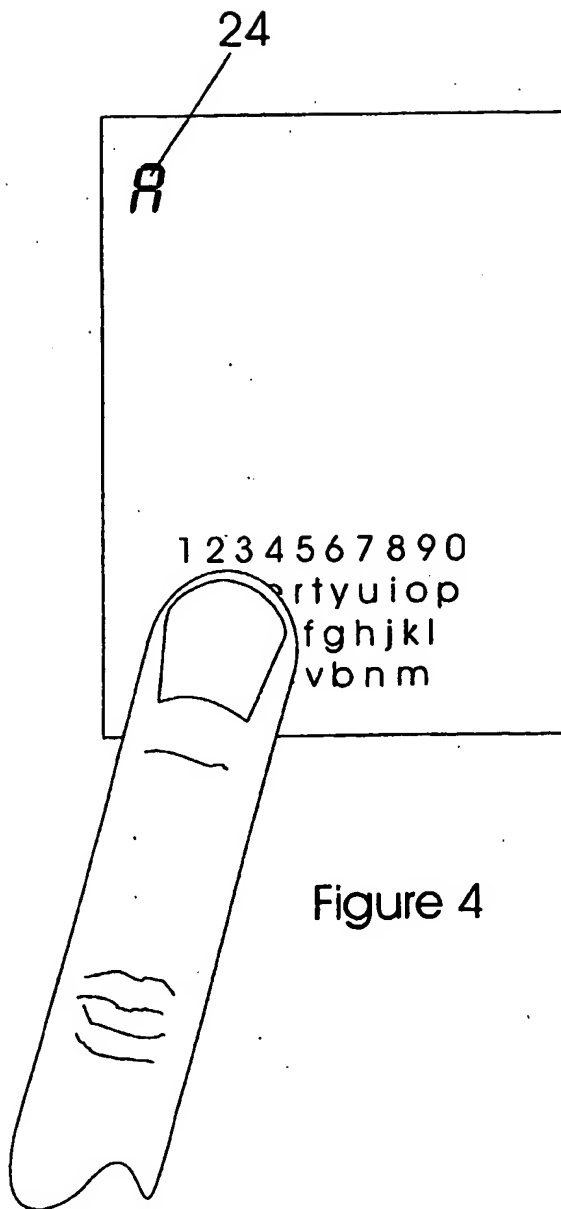
Figure 4

A. MESSULAM
+44 20 84218197

1 2 3 4 5 6 7 8 9 0
q w e r t y u i o p
a s d f g h j k l
z x c v b n m

Figure 6

INPUT DEVICE FOR ELECTRONIC EQUIPMENT

This invention relates to the manual keying, without additional aids, of data into devices that are too small to have a keyboard and/or where items that need to be displayed on the screen for individual manual selection (selectable items) are smaller than a fingertip, that is, devices such as calculators, palm top computers, mobile communication devices, wrist instruments, controllers, special purpose equipment, and other electronic devices,

Mobile phones utilise a keypad having upwards of twelve protruding keys, each suitable for fingertip actuation (throughout the present specification, the word "fingertip" is used to include the tip of the thumb as well as a finger). These keys relate to digits 0 - 9 and some further keys for performing other specific functions. Text entry may be accomplished by assigning each numeric key with three alphabetical characters. The user is required to press the same numerical key repeatedly until the correct character is input. This may be confusing and is time consuming. Methods of avoiding this delay have been proposed in the form of predictive text messaging which attempts to predict the word the user is in the process of entering based on the letters already chosen. Although far quicker, it is not intuitive to use and it suffers from the disadvantages that unknown words often require tedious corrections and the user must constantly be on the lookout for incorrect predictions.

Palm top computers and personal organisers use a stylus. This is a pointer that behaves like a pen and writes on a touch sensitive screen creating an electronic mark on the (normally LCD) screen. These may be combined with character recognition, so that handwriting ("graffiti") may be "read" by the device. Alternatively, a selection of small alphanumeric characters is provided on screen, and the user is required to use the stylus in order to select the desired

character. This is disadvantageous in that it requires at least two hands to operate, and also the stylus is awkward to use and may be easily lost.

5   Further known methods include touch sensitive screens wherein fingertip selection is employed. In such devices, if the selected item is highlighted, this occurs inseparably from its entry. Although intuitive to use, this creates bulky hardware as they require the selectable characters to

10   be at least the size a fingertip in order to avoid false entries. In turn this means that only a small selection of characters or variables can be displayed on screen at any one time, practically eliminating the prospect of using a "QWERTY" style keyboard.

15

With progress in chip manufacture, electronic devices are becoming smaller. The limiting factor of their size eventually deriving from·the size of the keyboard and display screen. There is therefore a need to facilitate data

20   entry by means of a small input device.

According to the present invention there is provided input device for electronic equipment comprising a display screen, means for driving the screen to display a choice of

25   selectable variables, fingertip sensing means for detecting the position of a fingertip, means for determining one displayed variable on the screen as corresponding to the currently sensed fingertip position means for highlighting the variable corresponding to the currently sensed fingertip

30   position to distinguish the latter variable from the other variables available for selection before said variable is entered, and means separately operable to enter into the electronic equipment the currently highlighted variable.

35   In a preferred embodiment of the invention, the area occupied on.the screen by each variable displayed for selection is less than the area of a fingertip.

The input device provides feedback to the user that confirms the selection that has been made before the relevant variable is entered into the electronic device, thus allowing its correction before its entry. It is because of this that the size on the screen of the displayed variables can be smaller than a fingertip.

The term 'enter' refers to activating the purpose for which the selected variable was selected. This comprises adding to the inputted text that is displayed in a separate section of the screen (or a separate screen), activation of editing operations in the already inputted text, submitting for participation in calculations, activation of functions and operations, etc.

The variable that corresponds to the current fingertip position may be distinguished by changing the brightness, the size or the font, by flashing, bolding or by other means. It could even be aural. The method most suitable to a small LCD display is to change from a positive to a negative image of the variable. For simplicity, all such methods of visually distinguishing will hereinafter be referred to as highlighting.

Another advantage of enabling the use of virtual (or 'soft') keyboards is that the order of the characters can be rearranged, e.g. alphabetical, QWERTY etc., and letters of different language can be used.

Entering of the currently highlighted variable may be effected by means of a pressure sensitive switch. Preferably this would be done by applying extra pressure by the finger at its current position, thus activating a switch attached to the screen. To prevent entry of an undesired variable (to which the finger is moved inadvertently while pressing the switch, the device may ignore actuation of the switch if the

relevant variable has been highlighted for less than a
predetermined length of time.

As an alternative to the use of a pressure sensitive
5   switch to input the highlighted variable, the variable may
be automatically entered when the fingertip keeps it
highlighted for more than a predetermined length of time.

The invention will now be descried further by way of
10   example and with reference to the accompanying drawings in
which:
            Figure 1 shows a conventional mobile phone utilising
an alphanumeric keypad as is common in the art,
            Figure 1a shows a conventional calculator also
15   utilising an alphanumeric keypad as is common in the art,
            Figure 1b shows a calculator of the invention having
more functions than the calculator shown in Figure 1a,
            Figure 2 shows the touch screen according to the
preferred embodiment, as it would be seen by a user,
20   Figure 3 is the same view as in figure 2 during its
first stage of use,
            Figure 4 is the same view as in figure 3 during a
later stage of use,
            Figure 5 is the same view as in figure 4 during a
25   still later stage of use, and
            Figure 6 is the same view as in figure 5 after data
entry has been completed.

            Figure 1 shows a conventional mobile phone device 10
30   which utilises a protruding keypad 12. Data input via the
keypad is displayed on LCD screen 14. As can be seen in
figure 1 it is common for phones to be used for text
messaging, phone numbers to be stored in the internal phone
memory and other uses, all giving rise to the need to enter
35   text. As such it is insufficient for the keypad 12 to simply
provide for numerical input. In such devices number keys "2"
to "9" on the key pad are each attributed with at least

three letters. In order to display a letter on screen, the key is pressed repeatedly until the corresponding letter appears on screen 14 when the phone 10 is expecting a text input as opposed to a numerical input.

5   For example in order to generate a "k" the 5 key must be pressed twice when the phone is expecting a letter entry. Similarly, to produce a "y", the 9 key must be pressed three times. Obviously this will be time consuming when a long

10 name is required.

     Figure 2 shows the face of a touch sensitive screen 16 according to the preferred embodiment, which is intended to replace the screen and keypad of such a device as shown in

15 figure 1. When required, the screen shows a list of selectable variables 18. In this example the list comprises the 26 letters of the alphabet and Arabic numerals 0 to 9 (This is often referred to as 'virtual' or 'soft' keyboard).

20   Figures 3, 4, 5 and 6 show the stages in which characters are input in order to appreciate how the present invention is intended to function.

     The operator of the device uses his/her finger 20 to

25 touch the screen at the desired character, in this case the letter A. It is important to note that due to size constraints, the finger tip is likely to be significantly larger than the desired character, such that the finger 20 covers or points at the desired character and several other

30 surrounding characters. At this point based on the signal provided by the touch sensitive screen 16, the device can estimate which character has been selected based on the where the touch has been detected. If the desired character is chosen by the finger covering it, then for example the

35 finger could be covering a square of nine different characters, the device may decide that the desired character is the central character. When a decision has been made, the

most likely obscured character is displayed separately in
the centre of the screen highlighting which character the
device considers to be most likely. Preferably, the
highlighted character could be displayed surrounded by, in
5   smaller fonts, the characters immediately neighbouring (on
the keyboard). In this case that letter is "A" 22. There are
obviously many algorithms for determining which letter is to
be selected.

10   The apparatus described above can of course be made to
operate in many ways each achieving the same result. For
example, a preferred way would be to identify the desired
character by pointing at it, that is, positioning the finger
under the desired character rather than positioning the
15   finger on it (as shown in Fig. 1b), and the device then
determines the selected character as that immediately above
the finger rather than at the centre. In this case, as is
preferable to avoid having to move the eyes away, the
selected character can then be highlighted in situ (see the
20   digit 9 in Fig. 1b), that is on the keyboard itself, by
reversing black/white, framing, bolding, flashing or other
means. Should the desired letter not be the one intended by
the position of the finger 20, the user would simply move
or roll his/her finger until the correct character 22 is
25   displayed at the centre of the screen 16 or highlighted in
situ as detailed above.

When the displayed highlighted character 22 is indeed
the intended one, the user is required to push harder on the
30   screen to enter it. This will detected by way of a separate
pressure sensor (not shown) mounted behind the screen. Such
a sensor could be a biased switch under the screen, or a
piezo crystal under the screen or in the frame holding the
screen, or other methods.   Selection by the user will cause
35   the highlighted character 22 to be displayed in the area
designated for displaying entered text 24. At this point
(figure 5) the user is then ready to repeat the selection

for the second letter, in this case letter "M". The process is then repeated until the entire entry is complete (figure 6).

The finger's position-sensing could be achieved by various technologies, such as resistive touch-sensitivity, capacitive, thermal or others. It is of course entirely possible to use a thumb rather than a finger, thus enabling single handed operation. Throughout the present specification, the term 'finger' is intended to include a thumb and 'fingertip' should also be construed accordingly.

The invention is based on the fact that while it is difficult to 'land' accurately on or by a desired small item it is easy to, controllably, adjust the finger's or thumb's position in fine steps. This can be particularly fine-tuned by 'rolling' the thumb/finger rather than shifting.

There is, of course, no reason why such a method of entry should be limited to data input. Any process on a device which requires a selection of any kind to be made could be performed in the same way, such as the selection of icons rather than characters. For example, menu selection requires a user to scroll through a choice of broad functions, each selection, producing a further list of narrower choices, this repeats until the exact function is desired is reached. The advantage is that a small screen could contain a much greater number of icon than presently possible for selection by a keypad alone.

The apparatus may also be used for editing text which has previously been entered. Again, a character that needs to be edited (for example, for deletion, moving or replacement) would be selected by pointing at it, it would then be highlighted and a possible correction in identifying the item to be edited would be made by shifting/rolling the finger, the correct selection then confirmed by pressing

harder or by sustaining the highlighting by the continued
presence of the finger for a given duration.

5   Selecting a passage could be performed by keeping the
finger in touch with the screen after the first selection
and sliding the finger to the end-character which is entered
in the same way as above. Lifting the finger and touching
any point in the highlighted passage, and then sliding the
finger, would drag the passage to a location which, again,
10 is identified as above. 'Cursor positioning' between two
characters could be afforded by back-and-forth selection of
two neighbouring characters.

The top surface of the screen could have a relief,
15 particularly useful for mobile phones if the soft keypad
would replace the mechanical one.

Figure 1a shows a conventional calculator which has no
need for the entry of text. A calculator embodying the
20 present invention, as shown in Fig. 1b, need have no moving
keys at all - every function being selectable from the
screen. It is further possible to utilise a separate touch
sensitive pad, therein removing the need for a touch
sensitive screen. This would allow the an embodiment of the
25 present invention to be retro fitted to devices already
having a non-touch sensitive screen.

Claims

1. An input device for electronic equipment comprising:

a display screen,

means for driving the screen to display a choice of selectable variables,

fingertip sensing means for detecting the position of a fingertip,

means for determining one displayed variable on the screen as corresponding to the currently sensed fingertip position

means for highlighting the variable corresponding to the currently sensed fingertip position to distinguish the latter variable from the other variables available for selection before said variable is entered, and

means separately operable to enter into the electronic equipment the currently highlighted variable.

2. An input device as claimed in claim 1, wherein the area occupied on the screen by each variable displayed for selection is less than the area of a fingertip.

3. An input device for electronic equipment as claimed in claim 1 or 2, wherein the fingertip sensing means is arranged on the display screen such that the user may point to an area on the screen in order to select the desired variable.

4. An input device for electronic equipment as claimed in any preceding claim, wherein the separately operable means to enter into the electronic equipment the currently highlighted variable are operable by the finger that made the selection without having to alter the location of that finger between the selection and the entering.

5. An input device as claimed in any preceding claim, wherein the means operable to enter the currently highlighted variable include at least one pressure switch associated with the touch screen such that further pressure on the screen will select the highlighted input.

6. An input device as claimed in any preceding claim, wherein entry of the highlighted variable is disregarded in the event that the variable was highlighted for less than a predetermined length of time.

7. An input device as claimed in any preceding claim, wherein the currently selected variable is entered automatically when the variable remains highlighted for longer than a predetermined length of time.

8. An input device as claimed in any preceding claim further having means for predicting the desired word to be input based on the characters already input into the device.

9. An electronic device incorporating an input device as claimed in any preceding claim said input device acting in lieu of or in addition to keys of a key pad.